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House Energy and Air Quality Subcommittee

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PREPARED TESTIMONY:
**The Oil Industry Growth Challenge: Expanding
Production Capacity**

By Robert Esser, CERA Senior Consultant and Director, Global Oil and Gas Resources

Mr. Chairman, Members of the Committee.

It is an honor to address this Committee on the critical issue of the nation's—and the world's—oil supply. We need a global perspective; after all, the United States is so inextricably bound up in a global marketplace. We all recognize the importance of energy to our nation's future, and the Committee is to be commended for seeking to clarify and elucidate this important subject. As a nation, we have previously gone through periods of deep concern about the adequacy of energy supplies. High prices, tight supplies, rapid demand growth, and political turbulence—all these have come together to put the spotlight on this question once again and have combined to create the urgency that is reflected in today's hearings.

The Committee has asked us to address the question of Peak Oil. In our view, this is not a very helpful concept, nor one that provides much descriptive power. Rather than an imminent “peak,” we envision an “undulating plateau” two to four decades away. We at Cambridge Energy Research Associates have been conducting continuing research on future oil supplies, working up from a field-by-field basis. Now that we are part of IHS, we can enhance our analysis by calling upon IHS' upstream oil field data bases, which are the largest and most complete in the world.¹

This is an issue that needs most serious consideration. After all, the planet has a finite resource, and the world is consuming 30 billion barrels a year. But the understanding of the situation that needs some clarification. Key considerations include technology, economics, timing, fiscal and regulatory terms, and a comprehensive understanding of current and future productive capacity. As we see it, the model for peak oil has been and continues to be flawed. The resource base is still poorly understood and it appears to continue to expand.

Our key points are as follows:

1. The world is not running out of oil in the near or medium term. Our field-by-field activity-based analysis points to a substantial build-up of liquid capacity over the next several years.

¹ See Peter Jackson and Robert Esser CERA *Private Report, World Liquids Capacity Outlook to 2010: Tight Supply or Excess of Riches?*

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2. An increasing share of supplies will come from "non traditional oils"—from the ultra-deep waters, oil sands, natural gas liquids, gas-to-liquids, coal-to-liquids, etc. As time goes on, these "non-trationals" will become more traditional.
 3. Rather than a "peak," we should expect an "undulating plateau," perhaps three or four decades from now.
 4. One reason for the pessimism about future supplies is that the reserves disclosure rules mandated by the Securities and Exchange Commission are based upon three decades old technology, and need to be updated. (We discuss this later in this written testimony).
 5. The major risks to this outlook are not below ground, but above ground—in such forms as political turbulence, abrupt changes in contract terms, and controversy over fiscal terms.
 6. Meeting the energy needs of a growing world in an environmentally-sound fashion will be a major challenge. Doing so will require substantial investment and continuing technological innovation and will more likely be achieved through an open global economy.

The most fundamental challenge facing the global oil industry is to increase oil production capacity. This challenge is not new. Indeed, rising prices and the current thin cushion of spare oil production capacity have resurrected an old worry: fear that the world is running out of oil. This has been a recurrent theme ever since the first oil well began production in Pennsylvania in 1859. It gathers steam and garners media attention about once every generation or so—particularly when oil prices are on the rise.

Are we running out of oil? CERA's belief is that the world is not running out of oil imminently or in the near to medium term. Indeed, CERA projects that world oil production capacity has the potential to rise from 87 million barrels per day (mbd) in 2005 to as much as 108 mbd by 2015.² After 2015 we see further growth in capacity. Our outlook contradicts those who believe that peak oil is imminent.

Although there have been recent downside factors such as the slowing rate of expansion of capacity in Russia and continuing problems in Iraq, this is balanced by a more positive outlook for major producing countries such as Angola and Brazil, where a stream of large projects continues. In addition to crude oil from conventional settings, our analysis concludes that unconventional oil—condensates, natural gas liquids (NGLs), deepwater production, extra heavy oils and gas-to-liquids (GTLs) will represent about 35 percent of total capacity in 2015—compared to 10 percent in 1990.

To be sure, many significant risks to production capacity loom on the horizon, but these are largely above-ground risks. Perhaps the greatest problem at present is the severe lack of qualified manpower resources and limits imposed by rig and yard availability and materials. At current high oil prices most oil companies want to increase activity levels, especially with existing producing fields, that will have a rapid return on investment, but increased competition has driven the cost of manpower and services higher. In addition, although we do not see a global peak in production capacity, the rate of growth in non-OPEC capacity will likely slow after 2010.

Political risks also have an impact on capacity expansion in the Middle East, where the situation in Iraq continues to be highly problematic, and there is growing uncertainty over events

² Oil refers to crude oil, condensate, natural gas liquids (NGLs), and other sources of liquid hydrocarbons.

in Iran. In Russia, changes in ownership, the constraints of geology, and the fiscal and regulatory systems, as well as logistical bottlenecks and geological challenges – all these have led to the end of Russia's high supply growth era. In Venezuela fiscal and political changes have hindered the recovery of oil production and investment in the aftermath of the late 2002/early 2003 disruption and are likely to have continuing impact.

Our views about the peak oil debate have been reinforced by a detailed new audit of our own analysis and also further evidence that has come to light concerning the enormous scale of field reserve upgrades of existing fields. We also draw upon the proprietary databases of IHS, of which CERA is now part. These are the most extensive and complete databases on field production around the world. We see no evidence to suggest a peak before 2020, nor do we see a transparent and technically sound analysis from another source that justifies belief in an imminent peak. It will be a number of decades into this century before we get to an inflexion point that will herald the arrival of the “undulating plateau.”

CERA'S METHODOLOGY

CERA methodology generates an activity-based model that involves a rigorous bottom-up analysis of each country, for which we sum component capacity profiles for fields in production (FIP), fields under development (FUD), fields under appraisal (FUA), and a yet-to-find (YTF) component. Decline rates are built into this analysis. It is important to understand that we do not predict production as such, but rather capacity to produce, and that our assessment is lower than the industry aggregated total. We do not simply focus on crude oil alone, but encompass unconventional liquids including condensates, natural gas liquids (NGLs), heavy oils, and ultra deepwater oils. Many of the other projections available do not include all of these components, and this may explain why CERA's outlook is different. We also recognize that above-ground developments could lead to capacity growth's falling short of its potential.

Major Trends and Signposts

Assuming no serious political crises in key producing countries or an unexpected shortfall in investment, global oil production capacity will continue to grow strongly toward 102.4 mbd by 2010 from the current level of 87.2 mbd. This expansion will be fairly evenly split between OPEC and non-OPEC countries: 8.5 mbd and 6.7 mbd, respectively. The expansion continues to 2015, but OPEC shows a greater increase: a net gain of 12.2 mbd (relative to 2005) versus 8.2 mbd for non-OPEC. At the regional level, the United States and North Sea show decreases to 2015 while Canada, West and North Africa, Latin America, and the Caspian, and the Middle East continue their current trend of strong expansion past 2010 and through 2015. Southeast Asia shows some modest growth, but declines after 2010. At the same time, Russian capacity growth slows.

By 2015 we also see a change in the geographic focus of the sources of liquids supply. The proportion of liquids capacity from the top 15 countries will rise from 58 percent in 2005 to 65 percent in 2015. While nearly every OPEC country, except Indonesia, shows potential for a significant increase to 2015, the sources of expansion in non-OPEC countries are more limited, with Russia, the Caspian nations, Brazil, Angola, and Canada leading the way. We also note the emergence of some new sources of liquids capacity both in the deep water, such as offshore Mauritania, and onshore in Sudan. In addition, mature areas such as Malaysia are reemerging and a new play is being successfully explored and developed in a previously unexplored deepwater area offshore Sabah, in northwest Malaysia. However, this shift in emphasis may prove to be to

more politically and operationally challenging countries, which increases the levels of risk and supply anxiety in some consumer countries.

There are a large number of major projects in both OPEC and non-OPEC countries that underpin the increases. The top 10 projects being brought onstream each year will together add a cumulative gross capacity of 2.0–2.5 mbd per year until 2010 alone. These projects were approved under a much lower oil price regime, and even if the oil price falls significantly these projects will proceed. While there has been some slippage (e.g., Thunder Horse and Adar Yale), other projects began production ahead of schedule (e.g., Kizomba B, Whiterose).

Trends in Crude Quality and Unconventional Liquids

Analysis of the composition of new capacity shows that in the medium term there will be increasing proportions of light and heavy oils and a reduction in the proportion of medium grade crude. However, capacity additions to 2010 are predominately light (8 mbd), medium (5 mbd), and heavy (3 mbd) We also see a continuing rapid expansion of deepwater production capacity up to 2010, with a major surge from 3.4 mbd in 2005 to over 9 mbd by 2010. This surge will be dominated by growth from the “big four” deepwater areas: the US Gulf of Mexico, Brazil, Angola, and Nigeria, with more modest contributions from other areas.

Production capacity of extra heavy oil from Canada and Venezuela will expand from 1.8 mbd in 2005 to 4.9 mbd in 2015. Despite accidents earlier in 2005 the Canadian projects are moving forward at an accelerating pace. Expansion from 1.2 mbd currently to 3.4 mbd by 2015 is anticipated, with approximately half being mined and the remainder in situ. In Venezuela the four main Orinoco projects are onstream (totaling 650,000 bd) and with debottlenecking could reach 700,000 bd by 2010.

Between 2005 and 2015 there is considerable potential to expand total condensate plus natural gas liquids (NGLs) capacity from 14 mbd to 22 mbd.² Notable condensate expansions will occur in Qatar as the liquefied natural gas (LNG) business expands and more gas is produced for pipeline exports and GTL conversion. One of the largest expansions of condensate capacity will occur in Norway. The story for NGLs is similar, with much of the expansion to 2010 occurring in many OPEC countries, including Saudi Arabia, Qatar, and Nigeria. NGLs capacity in the United States will decline by 2010 in response to declining gas production.

Until recently the gas-to-liquids (GTL) business had contributed only a small proportion of production (160,000 bd in 2005), but there are a number of projects under way and planned that are expected to boost production capacity to 480,000 bd by 2010 and 1 mbd in 2015. This is a lower buildup than might be anticipated by summing the reports of current activity, but we expect that operators will not commit to new GTL projects until there is some certainty that the oil price will remain high on a sustained basis.³

OPEC Capacity Trends

Although most OPEC members are currently producing at or very close to capacity, they are in a strong position to expand total liquids production capacity to 49.9 mbd in 2015, with the proportion of condensates and NGLs rising by that time. Much of this expansion will tend to come from existing fields and discoveries rather than extensive new exploration. The key

³ Condensate and natural gas liquids (NGLs) are gas-related liquids. Condensate is a gas at depth but a liquid at the surface. NGLs are liquids removed from rich gas by processing and consist of propane, butane, ethane, etc.

challenges are to understand the impact of decision making and political uncertainties on project execution and to take into account price trends that will influence the buildup of capacity over the next half decade.

- **Saudi Arabia** possesses the largest resource base in the world, with 268 billion barrels of proven reserves. Recent reports suggest that some 200 billion barrels of reserves is likely to be added. CERA believes that, in common with other countries around the Gulf, the exploration potential is still very high, despite the high level of existing proven reserves. While there has been much debate about Saudi Arabia's ability to expand production capacity, we see no comprehensive justification of claims that production is about to "fall off a cliff." We anticipate an expansion of crude and condensate capacity from 11.1 mbd in 2005 to as much as 13.2 mbd by 2015. Saudi Arabia is working to sustain its 1.5–2.0 mbd level of surge capacity while concentrating on increasing production of lighter and sweeter crude oil.
- **Iran** is making slow progress in expanding capacity, which currently stands at just under 4.2 mbd. With relatively high annual decline rates, delays in bringing new projects onstream, problems with existing projects (Soroush-Nowruz), and the changing internal and external political environment, the rate of expansion will slow compared to previous projections, but is still expected to reach 5.2 mbd by 2015.
- **Iraq** did not reach its goal of achieving production of 2.8 mbd by April 2004. It is currently producing 1.9 mbd and it is difficult to predict exactly when the situation will stabilize and allow new investment in the oil and gas sector. We believe that progress will be slow, with capacity reaching 2.8 mbd by 2010 and 4 mbd by 2015. Iraq has the potential for sustained liquids capacity in excess of 5 mbd and has major exploration potential. It will likely be a major player in OPEC expansion after 2010.
- **Libya** has reopened its doors to US oil companies following the lifting of sanctions. Presanction license holders have renegotiated their contracts. In addition, a number of successful licensing rounds have occurred and we anticipate that new discoveries will start feeding into the development queue by 2007/08. Meanwhile, there is a backlog of discoveries to develop and the possibility of enhancing production from some of the major fields that have seen very little investment for 20 years. Libyan production capacity will average 1.8 mbd in 2005 and climb fairly slowly to 2.5–3.0 mbd by 2015. The higher number depends on a successful exploration program combined with a focus on improved oil recovery projects. This is still early days for the reopening, and it remains to be determined how rapidly activity will pick up.
- **Nigeria's** deepwater projects finally appear to be moving forward. Exploration appears to be bearing fruit with the recent new discoveries. Expansion of production capacity to 4 mbd by 2010 from the current level of 2.9 mbd is strongly supported by current development activity, but problems with ethnic tensions and strikes will persist.
- **Indonesian** production capacity is dominated by small, mature fields that show high rates of decline. Despite progress with the negotiation of the Cepu project (170,000 bd by 2008) and other new projects, as well as major efforts to attract

investment, we believe that Indonesia will struggle to expand capacity much above 1 mbd in the foreseeable future.

- **Venezuelan** capacity is expected to continue to grow slowly from 2.9 mbd in 2005 to 3.4 mbd by 2015, despite the huge resource potential. The Orinoco extra-heavy projects are currently contributing 650,000 bd. The sluggish recovery from the strike in 2002/03 is reflected by the continued slow increase in the number of active rigs and a slow buildup in investment. Also, changes in the investment and political climate will affect future levels of investment.
- **United Arab Emirates** crude plus condensate capacity is expected to expand from 2.9 mbd in 2005 to 3.5 mbd in 2015.
- In **Kuwait** expansion from 2.5 mbd to 3.5 mbd is expected between 2005 and 2015. The schedule for implementing Project Kuwait, aimed at increasing the production of Northern Fields from 600,000 to 900,000 bd, is not clear at this point..

Non-OPEC Capacity Trends

Non-OPEC countries have a considerable inventory of projects under way and planned by 2010. There are 80 projects with reserves greater than 100 million barrels and a further 120 with reserves above 20 million barrels due to come onstream before the end of 2008. Non-OPEC production capacity is set to rise to 56.3 mbd by 2010, with the rate of growth slowing after that point. Capacity has the potential to reach 57.8 by 2015. This apparent reduction in the rate of increase after 2010 could be real, but could also reflect the less clarity in that time period as to our lack of knowledge which projects are likely to be developed, given that our Supply Expansion outlook is an activity-based model.

- **Brazil.** Current production capacity of 1.8 mbd is set to expand to 2.9 mbd by 2010. With new projects coming on stream, and with the recent successful Seventh Licensing Round and continued exploration success, we envisage continued expansion in total production capacity well past 2010.
- **Angola.** Capacity is expected to expand rapidly from current levels of 1.3 mbd to 2.5 mbd by 2010. The string of deepwater discoveries in Angola continues. Developments in Angola, Nigeria, and elsewhere in the region will push West African liquids capacity up to 9.2 mbd in 2015, from 6 mbd in 2005.
- **United Kingdom.** The United Kingdom is typical of a mature basin that is past its geometric peak of oil production. Indeed, there were two peaks, in 1985 and 1999, which marked a plateau lasting more than 15 years. Capacity is now on a broadly declining trend despite the relatively high levels of activity. However, at the current high oil prices, and capitalizing on the extensive mature infrastructure, many small (less than 20 million barrels of oil equivalent) projects are being developed and helping to arrest the decline. Occasional major discoveries are still made in the United Kingdom, and a discovery on the Atlantic Margin could be developed soon after 2010. Even so, the overall trend is lower, and by 2015 we anticipate production capacity of 1.24 mbd (down from 2.09 mbd in 2005).
- **Norway** shows some slight positive momentum for capacity in the short term, but with current rates of success and an inventory of relatively small discoveries to

develop, CERA predicts that production capacity will decline from 3.3 mbd in 2005 to 2.3 mbd in 2015. Interest in the Norwegian continental shelf is undiminished, as reflected by the recent APA (awards in predefined areas) licensing round and the increasing number of companies seeking to qualify to invest. If these and other recent awards yield exploration wells, we could see liquids capacity expanding past 2010. The project aimed at prolonging the life of the Statfjord field to 2020 is now under way, and other mature fields (e.g., Draugen) are being short-listed for similar late life interventions.

- **United States.** Supply disruption from the 2005 hurricane season could run well into 2006. Currently roughly 540,000 bd of oil production remains shut in, with as much as one third to be shut in well into 2006. Also it is estimated that less than 25,000 bd of capacity will be permanently lost from the destruction of old facilities. Disruption of gas supply has resulted in a fall in NGLs production. These factors will slow new project start-ups in the short term, exacerbating the existing problem with the Thunder Horse facility, which will now probably not produce until late in 2006. US liquids capacity is expected to fall from 7.5 mbd in 2005 to 7 mbd in 2010.
- **Canada.** Major expansion is expected. The main story is the oil sands projects, where capacity is expected to increase from 1.2 mbd in 2005 to 2.4 mbd by 2010 and 3.4 mbd by 2015. Conventional crude capacity of 2.3 mbd will decline to 1.9 mbd by 2015.
- **Russia.** Although we have adjusted the rate of growth of Russian capacity downward in the light of recent events, production is holding up and has actually increased to 9.6 mbd recently, and will be buoyed through 2006 by the start-up of Sakhalin-1 this year. After a number of years of rapid expansion Russia is moving back to slower long-term liquids capacity growth rates. There is much debate as to the reasons for the slowdown, and certainly multiple factors are at work, but none of these are a shortage of resources in the ground^{3,4}.
- **Caspian region.** Progress continues with the completion of the Baku-Tbilisi-Ceyhan pipeline and solid progress with the ACG field development in Azerbaijan. In Kazakhstan, the giant Kashagan field may be delayed by a year to 2010, but we expect total Caspian production capacity to rise strongly from current levels of 2.2 mbd to 4.2 mbd in 2010 and 5.3 mbd in 2015.

What Could Go Wrong?

CERA's outlook for growth in oil production capacity incorporates elements of risk involving existing project problems, annual maintenance, new project delays and attrition, and the timing and scale of appraisal and exploration projects. But there is another group of major risks that will materialize. While there is uncertainty about decline rates and the scale of contributions from new projects and exploration, CERA believes the risks to capacity expansion are mostly above ground: People, rigs, yard space, and raw materials are in very short supply; costs have been driven up; and the situation shows no sign of easing. This will limit the expansion of the

⁴ See the John Webb, Konstantin Kovalenko, and Thane Gustafson CERA *Private Report, Why is Russian Oil Production Slowing Down?*

exploration effort and slow the rate at which new projects will be sanctioned. Other above ground risks are

- **Operational risks** exist, especially in extreme environments such as ultra deep water where the cost base and the subsurface risks are also higher.
- **Weather and environmental effects** can be broad and unpredictable. The impact of Hurricanes Katrina and Rita are still being felt in the US Gulf Coast, where some 0.54 mbd of production is still shut in.
- **Creeping nationalization and reconsolidation** is occurring in key producing countries.
- **Resurgent nationalism** in some countries is creating considerable turmoil and increased risks for both international oil companies (IOCs) and the now better-positioned national oil companies (NOCs).
- **Tightening fiscal terms** in response to higher oil prices and policy changes where governments and NOCs do not see inward investment as absolutely essential are an ongoing risk.
- **Violence and insecurity** is having an impact on production capacity in some areas.

THE SPECTER OF PEAK OIL: WHAT PEAK?

The question of a worldwide peak in oil production continues to stimulate debate. Our outlook shows no evidence of a peak in worldwide oil production before 2020. It is true that total annual global production has not been replaced by exploration success in recent years, but production has been more than replaced by exploration plus field reserve upgrades. In 1995–2003 global production of 236 billion barrels was more than compensated by exploration success and field upgrades that collectively added 144 billion barrels and up to 175 billion barrels, respectively. Although oil is a finite resource, we still do not have an exact estimate of total reserves; meanwhile global resources should continue to expand. Many basins, even those producing significant volumes of oil, remain underexplored.

CREATING A RELIABLE DATA SET

One of the reasons that there is so much debate over the whether the peak of oil production is imminent or not is that different observers rely upon different data sets. The most visible data are those published by E&P companies through their annual reports and the most extensive collection of such reports are the filings under United States Securities and Exchange Commission (SEC) rules for companies with securities listed in the US. However these data are overly conservative as evidenced by the extent to which upward reserve revisions outweigh downward revisions. As we noted earlier, while new exploration on its own has not replaced global production, revisions of earlier estimates have created a net gain in reserves despite production. Among other things, this structural bias provides less useful information to investors and sets a misleading baseline for estimating future oil (and natural gas) supplies.

Earlier this year, CERA published its Special Report *In Search of Reasonable Certainty*, marking the culmination of some nine months of research into whether and how the definitions of proved reserves promulgated by the SEC needed to be updated. One of the key conclusions of this work was that the rules were stranded in time—representing a vision of the industry rooted in

the technologies and structures of the 1970s. The result is that large portions of discovered fields maybe excluded from disclosure until later in their producing lives and that only a small portion of the overall picture is revealed by these disclosures. As often happens with regulatory systems that have been in place for three decades, it requires modernization to take into account almost revolutionary changes in technologies, and transformations in terms of market structure and geography. When the rules were promulgated, the government set U.S.oil and gas prices, there were no global markets for natural gas, and the deepwater frontier was 600 feet (compared to today's 12,000 feet).

CERA has been conducting further study around ways in which the excessively conservative structural bias of these disclosures could be corrected and expects to publish the results of this work early in the New Year. However, the strong conclusion is that it is only by separating the roles of standard setting from compliance monitoring that progress can be achieved. The most widely accepted definitions for oil and gas reserves are those of the Society of Petroleum Engineers-.

If the SEC were to adopt the SPE definitions and guidelines, this would lead to the creation of a globally consistent data set that covered the vast majority of the world's oil and gas reserves. As the very definition of what is oil begins to change with the addition of non-traditional resources such as syncrudes and GTLs and even liquid fuels made from coal, a reliable dataset will be even more vital to inform the debate about when the world may face an undulating plateau of global oil production.

<p>Robert W. Esser, CERA Senior Consultant and Director, Global Oil and Gas Resources at Cambridge Energy Research Associates (CERA), is an authority on worldwide oil and gas productive capacity, and on global exploration and producing activity. For the past 15 years. he has led</p>
